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European Organisation for
Technical Assessment
Organisation Européenne
pour l'évaluation technique

European Technical Assessment ETA 19/0181 of 30/04/2019

GENERAL PART

Trade name of the construction product

"La Pensilina" made of:

Base Rail

Clamping System

Structural laminated safety glass

Safety cams

Product family to which the construction
product belongs

**PAC 22: ROOF COVERINGS, LIGHTS, WINDOWS,
RELATED KITS AND ANCILLARIES**

**EAD 220025-00-0401: Cantilevered Structural Horizontal
Glazing (Structural Glass Canopy/Roof)**

Manufacturer

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Manufacturing plant

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This European Technical Assessment
contains:

**17 pages, including 7 annexes which form an
integral part of this assessment**

This European Technical Assessment is
issued in accordance with Regulation (EU)
n° 305/2011, on the basis of

**EAD 220025-00-0401: Cantilevered Structural
Horizontal Glazing (Structural Glass Canopy/Roof)**

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SPECIFIC PARTS

1. TECHNICAL DESCRIPTION OF THE PRODUCT

The Cantilevered Structural Horizontal Glazing (Structural Glass Canopy/Roof) "La Pensilina" is a kit and consists of:

- base rail;
- clamping system;
- structural laminated safety glass;
- safety cams.

Glass is cantilever fixed into the base rail with clamping elements and mechanically secured against pull-out with safety cams. All other glass edges are free and do not require additional supports. The base rail is fixed at the substructure through fixing elements, which are not part of this ETA and must be separately designed with the support.

1.1 Base Rail

System consists of 1 base-rail type.

The basic rail is an extruded aluminium profile EN AW 6063 T6, according to the standard EN 573-3:2013. The specifications and dimensions of base rail are defined in Annex A1.

1.2 Clamping System

The glass clamping system includes three seals: two in contact with the laminated glass plate, with supporting function, one in a tergal position with respect to the profile, on the upper part in contact with the substructure (see Annex A2). The seals are made of thermoplastic elastomer and polypropylene copolymer. The outline of the seal is shown in Annex A3. The main characteristics of the thermoplastic elastomer are: hardness Shore A 65 according to ASTM D 2240-15e1; modulus 100% 2.2 MPa according to the ASTM D 412-16; tear strength 22 MPa according to ASTM D 624-00(2012); elongation at break $480 \pm 100\%$ according to ASTM D 412-16. The main characteristics of the polypropylene copolymer are: hardness Shore D 73 according to EN ISO 2039-2:1999; tensile modulus 1300 MPa according to the EN ISO 527-2:2012; tensile strength at yield 24 MPa according to EN ISO 527-2:2012; elongation at yield $< 12\%$ according to EN ISO 527-2:2012.

1.3 Structural laminated safety glass

The product consists of 8 alternative laminated glass-types:

- **C1** VSG-TVG (TVG 8 mm + SGP 1.52 mm + TVG 8mm),
- **C2** VSG-ESG (ESG 8 mm + SGP 1.52 mm + ESG 8mm),
- **C3** VSG-AFG (AFG 8 mm + SGP 0.89 mm + AFG 8mm),
- **C4** VSG-TVG (TVG 8 mm + PVB 1.52 mm + TVG 8mm),
- **C5** VSG-ESG (ESG 8 mm + PVB 1.52 mm + ESG 8mm),
- **C6** VSG-AFG (AFG 8 mm + PVB 1.52 mm + AFG 8mm),
- **C7** VSG-TVG (TVG 10 mm + DG41 1.52 mm + TVG 6mm ¹),
- **C8** VSG-TVG+ESG (TVG 8 mm ² + SGP 1.52 mm + ESG 8 mm),

where:

VSG: Multilayer safety glass according to EN ISO 12543-1:2011, EN ISO 12543-2:2011, EN 14449:2005;

TVG: thermally toughened (soda lime silicate) safety glass according to EN 12150-1:2015 and EN 12150-2:2005 with bending tensile strength $f_k = 120 \text{ MPa}$;

ESG: heat-strengthened (soda lime silicate) glass according to EN 1863-1:2012/A1 and EN 1863-2:2005 with bending tensile strength $f_k = 70 \text{ MPa}$;

¹ The 6 mm-thick ply is placed at the top.

² The TVG pane is placed at the top.

AFG: annealed float (soda lime silicate) glass according to EN 572:2016 and EN 1288:2016 with bending tensile strength $f_k = 45 \text{ MPa}$;

SGP: ionometer sheet used in technical approval for VSG (e.g. German technical approvals AbZ Z-70-3-143 and Z-70-3-170 or French Avis Technique 6/12-2086 or equivalent), with tensile strength $f_k > 30 \text{ N/mm}^2$ and elongation on break $\varepsilon > 300\%$;

PVB: polyvinyl butyral foil according to prEN 16613:2017;

DG41: high performance polyvinyl butyral foil. Structural interlayer with elongation at failure 190%, tensile strength 33 MPa, Young modulus for a given load duration consistent with prEN16613:2017.

1.4 Safety Cams

Safety cams prevent the pull-out of the glass units out of the base-rail during accidental horizontal load occurrences, including the cases of destruction and down-folding of the glass-pane. They are made of a 50% glass-fiber reinforced engineering thermoplastic material with tensile modulus $E = 17000\text{--}18000 \text{ N/mm}^2$, tensile strength $f_k = 220\text{--}250 \text{ N/mm}^2$ and elongation at break $\varepsilon \cong 2.5\%$ according to EN ISO 527-2:2012. The outlines of the safety cam and of the safety lock are shown in Annex A4.

2. SPECIFICATION OF THE INTENDED USE IN ACCORDANCE WITH EUROPEAN ASSESSMENT DOCUMENT N° 220025-00-0401

The product “La Pensilina” is intended to be used as structural glass canopy, structural glass roof or other horizontal structural glazing. The glazing is not walkable (even for maintenance purposes). It consists either of single glass units or it can be consecutively, independently aligned to form a stripe of undefined length. The system can be installed inside or outside buildings, where it can be exposed to adverse weather conditions. An average ambient air temperature should be in the range from -15°C to 45°C or according to national assessment for individual system components, with a relative humidity in the range 0-100%.

Concerning product packaging, transport and storage it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport and storage, as he considers necessary in order to reach the declared performances.

The information about installation is provided with the technical documentation from the Manufacturer and it is assumed that the product will be installed according to it or (in absence of such instructions) according to the usual practice of the building professionals. The specifications and conditions given by the manufacturer are summarized in Annex B.

The performances assessed in this European Technical Assessment, according to the applicable EAD, are based on an assumed intended working life of at least 20 years, provided that the conditions for the installation, packaging, transport, storage, installation as well as appropriate use, maintenance and repair are met. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3. PERFORMANCE OF THE PRODUCT AND REFERENCES TO THE METHODS USED FOR ITS ASSESSMENT

The assessment of the performances of the various types of cantilevered structural horizontal glazing “La Pensilina” in relation to BWRs has been made in accordance with the European Assessment Document (EAD) no. 220025-00-0401, edition April 2016.

#	Essential characteristic	Performance
Basic Work Requirement 1: Mechanical resistance and stability		
1	Mechanical resistance and stability to snow and wind load to EN1991	See Section 3.1 and Annex C1
Basic Work Requirement 2: Safety in case of fire		
2	Reaction to fire	Metal components: Class A1 Kit: No Performance Assessed
Basic Work Requirement 4: Safety and accessibility in use		
4	Resistance to the pull-put of pane	See Section 3.3.1
5	Soft body impact resistance	See Section 3.3.2
6	Hard body impact resistance	See Section 3.3.3
7	Residual load capacity of the product	See Section 3.3.4

3.1 MECHANICAL RESISTANCE AND STABILITY (BWR 1)

3.1.1 Mechanical resistance and stability to snow and wind load to EN1991

The assessment of mechanical resistance and stability for the intended use of the product “La Pensilina” has been made in accordance with EAD 220025-00-0401, clause 2.2.3 and Annex A. The ultimate descending (snow and wind) and ascending (wind) surface loads for each horizontal glazing type (see Section 1.3) characterized by the maximum overhang length (1.20 m) are recorded in Table 1.

Ultimate Load	C1	C2	C3	C4	C5	C6	C7	C8
	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]
Descending	6.75	5.75	4.50	4.5	3.33	1.63	5.87	6.75
Ascending	1.80	1.42	1.20	1.36	1.30	0.40	1.23	1.80

Table 1. Ultimate loads for horizontal glazing with overhang length 1.20 m.

According to the EAD 220025-00-0401, clause 2.2.3.2 and Annex A, the characteristic values of the loads must be lower than the ultimate loads divided by relevant safety factors. These characteristic values for descending and ascending loads, considering a safety factors equal to 1.5, are recorded in Table 2.

Characteristic Surface Load	C1	C2	C3	C4	C5	C6	C7*	C8**
	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]	[kN/m ²]
Descending	4.50	3.80	2.05	2.65	2.20	1.05	3.80	4.50
Ascending	1.20	0.94	0.80	0.90	0.86	0.26	0.82	1.20

* The 6 mm-thick ply is placed at the top

** The TVG pane is placed at the top

Table 2. Characteristic surface loads for horizontal glazing with overhang length 1.20 m.

The relations between overhang length and the permissible cumulative surface load, for both descending and ascending loads, are shown in Annex C1. The diagram is based on combination of results from calculations of system components assisted and verified by full-scale testing.

3.2 SAFETY IN CASE OF FIRE (BWR 2)

3.2.1 Reaction to fire

Metal components of horizontal glazing satisfy the requirements of Class A1 of the reaction to fire performance according to the EN13501-1, *EC Decision 96/603/EC*, amended by *EC Decision 2000/605/EC* (Classified without further testing), and the *Commission Delegated Regulation (UE) 2016/364*.

This performance **has not been assessed** for the cantilevered structural horizontal glazing intended as a kit.

3.3 SAFETY AND ACCESSIBILITY IN USE (BWR 4)

3.3.1 Resistance to the pull-out of pane

The assessment of pull-out resistance for the intended use of the product "La Pensilina" has been made in accordance with EAD 220025-00-0401, clause 2.2.5 and Annex B. The characteristic pull-out resistances are:

- $F_{EU} = 9.84 \text{ kN}$ (Types: **C1**, **C2**, **C4**, **C5**, **C6**, **C7**, **C8**);
- $F_{EU} = 5.76 \text{ kN}$ (Type **C3**).

3.3.2 Soft body impact resistance

The resistance to structural damage from soft body impact load with 50 kg bag has been assessed in accordance with EAD 220025-00-0401. The horizontal glazing types **C3** and **C5** are categorized as **SB 300**, the types **C2** and **C7** as **SB 800**, the types **C1**, **C4**, and **C8** as **SB 1200**, and, the type **C6** is categorized as **SBA 200**. The categorization of the types of horizontal glazing is summarized in Table 3.

Canopy Type	Category	Impact Energy Vertical Impact
C1	SB1200	1200 J
C2	SB800	800 J
C3	SB300	300 J
C4	SB1200	1200 J
C5	SB300	300 J
C6	SBA200	200 J
C7	SB800	800 J
C8	SB1200	1200 J

Table 3. Large soft body impact category for each horizontal glazing type.

3.3.3 Hard body impact resistance

The hard body impact resistance has been assessed according to the EAD 220025-00-0401. This characteristic has **not been assessed** for horizontal glazing type **C6**. **No penetration was observed** for the types **C1, C2, C3, C4, C5, C7**, and **C8**.

3.3.4 Residual load capacity of the product

The residual load bearing characteristics have been assessed according to the EAD 220025-00-0401, by using the criteria for the categorisation of the horizontal glazing as defined in clause 2.2.8 point a). This characteristic has **not been assessed** for types **C1, C3**, and **C8**. The types **C2, C5**, and **C6** are categorised as **RL2 – cantilevered canopy**, the types **C4** and **C7** as **RL1 – cantilevered roof**. Base rail remained fixed in its original positions for more than 24 h after the last imposed damage to the glass pane. The results of the tests and categorization for each horizontal glazing type are summarized in Table 4.

	Criterium [C1] <i>Failing Characteristics</i>	Criterium [C2] <i>Stability of damaged glass-pane</i>	Category	Description
C1	/	/	NPA	
C2	Passed	Passed	RL 2	<i>Cantilevered Canopy</i>
C3	/	/	NPA	
C4	Not Passed	Passed	RL 1	<i>Cantilevered Roof</i>
C5	Passed	Passed	RL 2	<i>Cantilevered Canopy</i>
C6	Passed	Passed	RL 2	<i>Cantilevered Canopy</i>
C7	Not Passed	Passed	RL 1	<i>Cantilevered Roof</i>
C8	/	/	NPA	

Table 4. Residual load capacity category for each horizontal glazing type.

Note: For some Member states, additional requirements for different characteristics may apply. These assessments or specific document shall be given separately together with an ETA.

4. ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE (AVCP) SYSTEM APPLIED, WITH REFERENCE TO ITS LEGAL BASE

In accordance with the European Assessment Document EAD No. 220025-00-0401, the applicable European legal act is: *Decision 1997/597/EC*. The AVCP system to be applied is **1**.

5. TECHNICAL DETAILS NECESSARY FOR THE IMPLEMENTATION OF THE AVCP SYSTEM, AS PROVIDED FOR IN EAD 220025-00-0401

Technical details necessary for the implementation of the AVCP system are laid down in the Control Plan deposited at ITC-CNR.

For type testing the results of the tests performed as part of the assessment for the European Technical Assessment shall be used unless there are changes in the production line or plant. In such cases the necessary type testing has to be agreed between ITC CNR and the Notified Body.

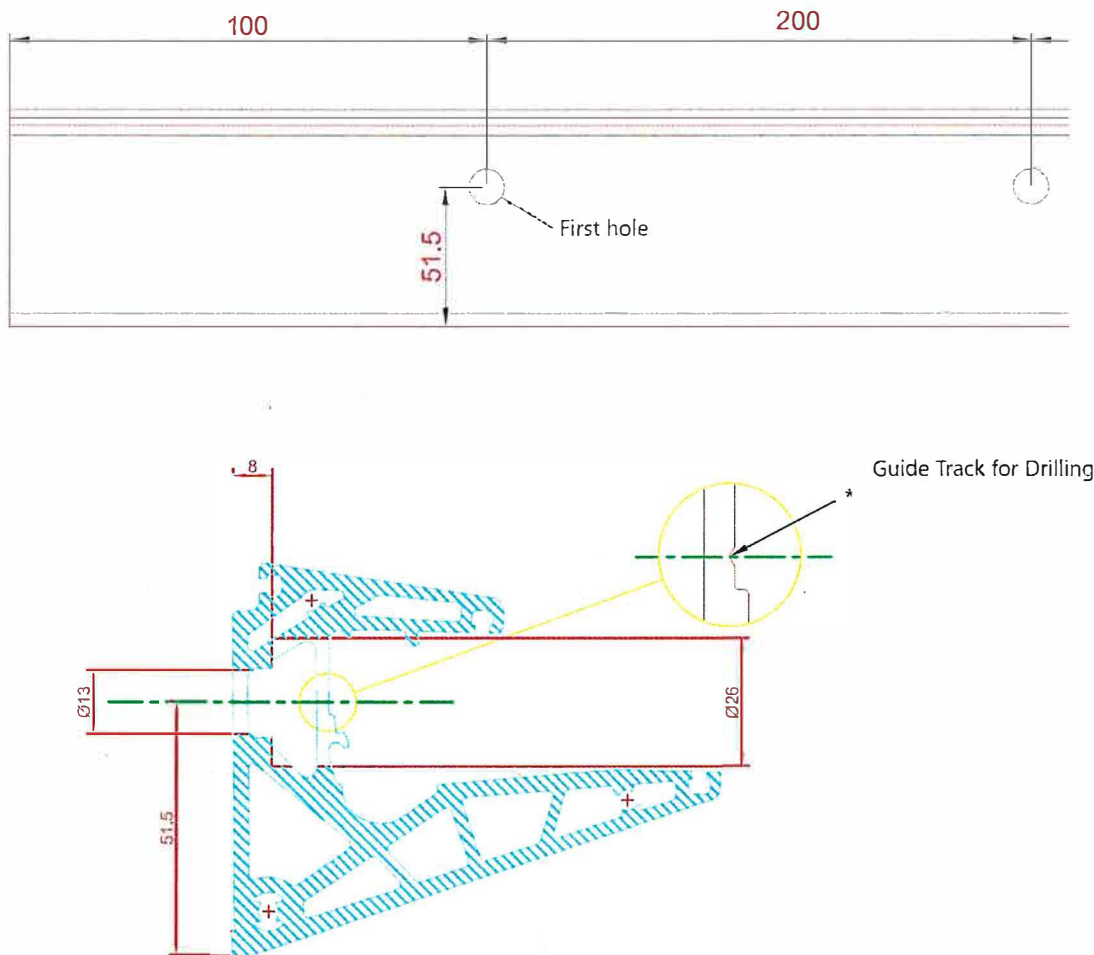
**Issued in San Giuliano Milanese, Italy on 30/04/2019
by ITC – CNR**

**Professor Antonio Occhiuzzi
Director of ITC-CNR**




Longitudinal View and Cross Section of the Base Rail

The base rail is an extruded aluminium profile EN AW 6063 T6, according to the standard EN 573-3:2013. The cross-section of the rail exhibits several alveolar cavities, whose function is to reduce weight of the element, and grooves that allow the insertion of the clamping elements. A principal cavity is present in the lower part of the rail, within which the safety cams are inserted. The base rail profile has a line of bores, useful for the fixing at the substructure. The gap between two adjacent profiles interlinked with a single glass pane should not exceed 40 mm. The maximum supply length of the profile is 3000 mm, while the minimum one is related to the possibility of inserting two consecutive safety cams.



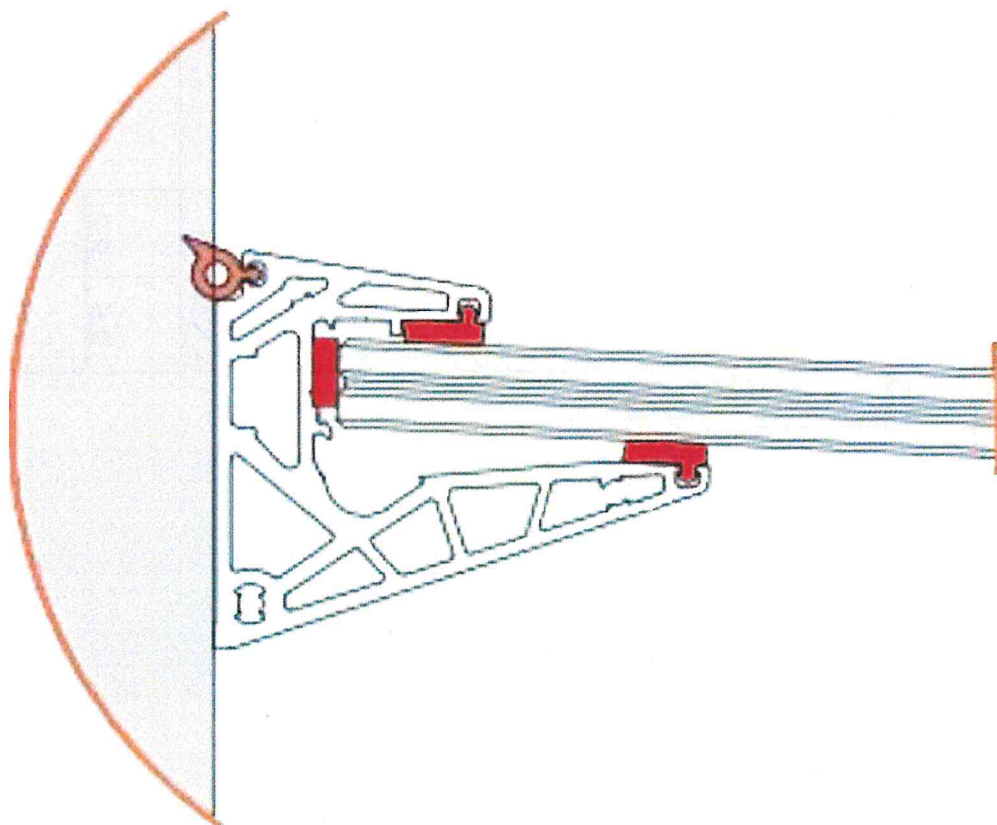
La Pensilina

Product Description – Longitudinal View and Cross Section
of the Base Rail

Annex A1
of ETA N° 19/0181

Detail of the Seals

Two seals are in contact with the laminated glass plate, while the third one is in a tergal position with respect to the profile, on the upper part in contact with the substructure. The seals in contact with the plate assured that the glass is not in contact with metal parts, so to guarantee the durability of the product. Friction between seals and glass surfaces provides pull-out resistance. The seal positioned between the base profile and the substructure has two functions: limiting infiltrations from meteoric source and uniform the contact surface between the edge top of the base profile and the substructure.



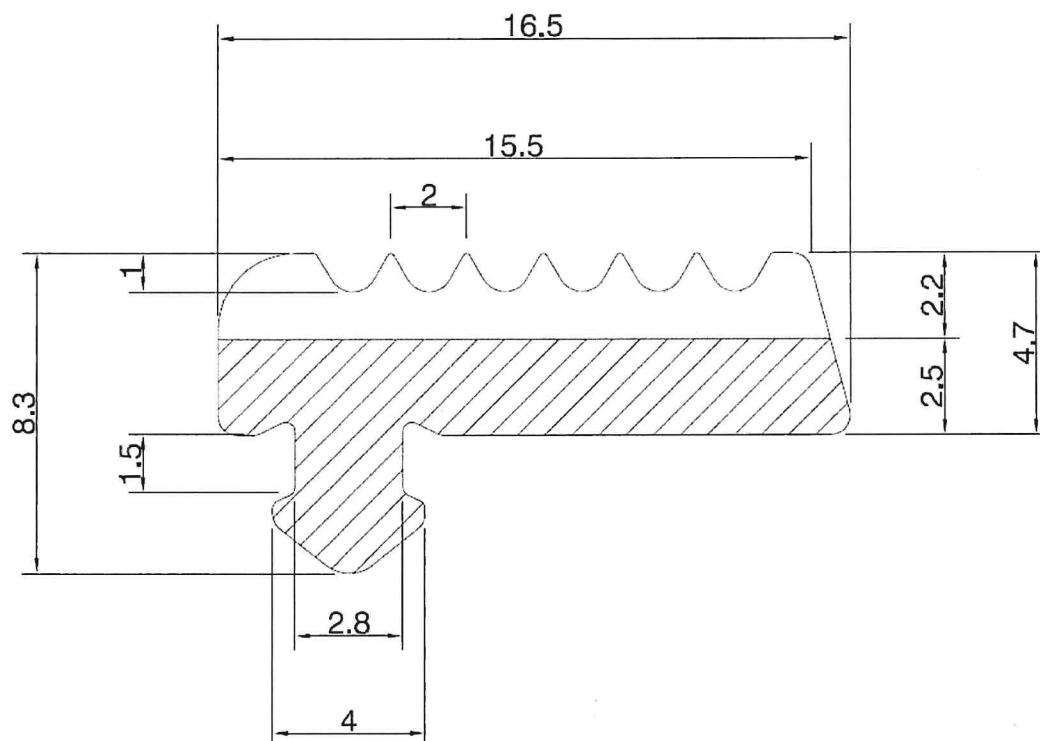
La Pensilina

Product Description – Detail of the Seals

**Annex A2
of ETA N° 19/0181**

Outline of the Seal

The seals are made of thermoplastic elastomer and polypropylene copolymer. The thermoplastic elastomer, softer than the polypropylene copolymer, is in contact with glass, allowing to minimize contact stresses.



-  Thermoplastic Elastomer
-  Polypropylene Copolymer

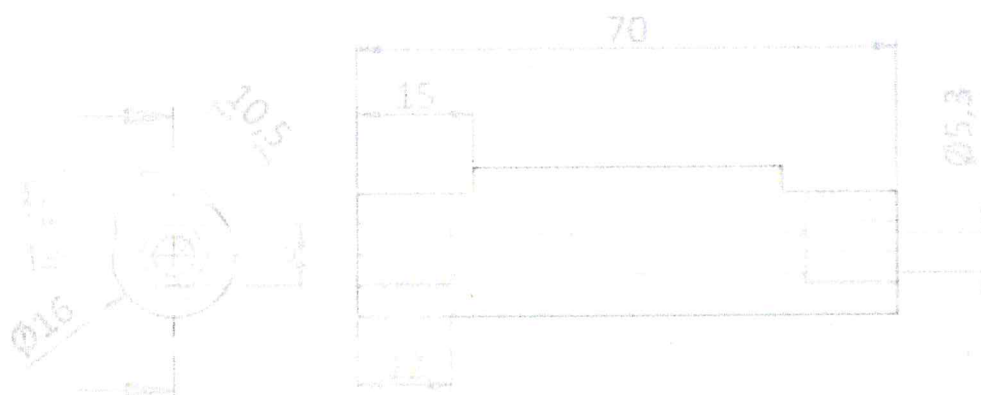
La Pensilina

Product Description – Outline of the Seal

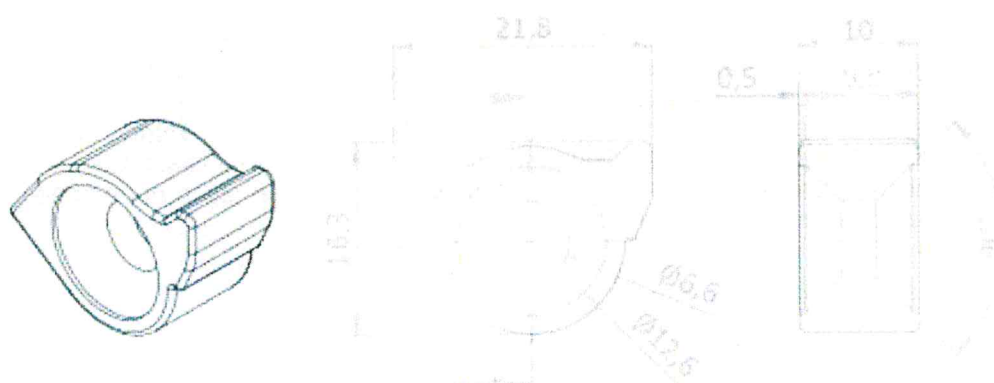
Annex A3
of ETA N° 19/0181

Outlines of the Safety Cam and its Safety Lock

The safety cams induce a pre-compression state in the thermoplastic seals. A safety lock that is put in contrast with the cam through a self-tapping screw locks the cam, whose geometry allows the installation of glass plates with different thicknesses.



Safety Cam



Safety Lock

La Pensilina

Product Description – Outlines of the Safety Cam and its Safety Lock

**Annex A4
of ETA N° 19/0181**

SPECIFICATIONS OF INTENDED USE

➤ INSTALLATION CONDITIONS

Temperature: -15 °C / +45 °C

Relative Humidity: 0 – 100 %

➤ WORKING CONDITIONS

Temperature: -15 °C / +45 °C

Relative Humidity: 0 – 100 %

➤ RECOMMENDATIONS FOR PACKAGING, TRANSPORT, AND STORAGE

The packaging must be made in accordance with best practice to safeguard the properties of the various components. Particular attention must be paid during packaging, transport and installation of laminated glass plates due to the brittleness of the material.

➤ RECOMMENDATIONS FOR REGULAR MAINTENANCE

Periodic cleaning of the product is crucial for the preservation of the original appearance. In outdoor environments, "La Pensilina" must be cleaned at least twice a year, but in coastal or urban environment, surfaces must be cleaned at least every three months. For internal installations, it is advisable to clean the product at least once a year. For cleaning, water and neutral soap must be used, together with a soft cloth or a non-abrasive sponge.

➤ RECOMMENDATIONS FOR SUBSTITUTION/REPAIR OF COMPONENTS/ELEMENTS

In case of breakage of one or more glass plies, a retaining system for the laminated plate must be quickly installed. Then, the damaged plate must be removed. The plate can be removed by rotating it in the opposite direction than the one for installation, described in Annex B2. During the removing operations, a retaining system must be applied at the damaged plate to avoid its accidental release and fall. Before inserting the new plate, it must be verified that the base rail is not damaged. The seals and safety cams must be substituted.

La Pensilina

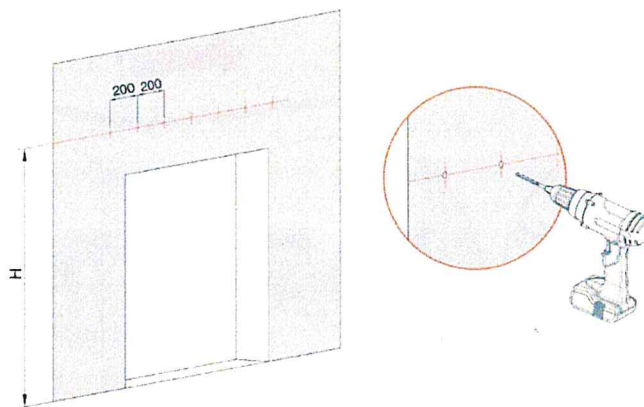
Intended Use – Specifications

Annex B1
of ETA N° 19/0181

INSTALLATION INSTRUCTIONS

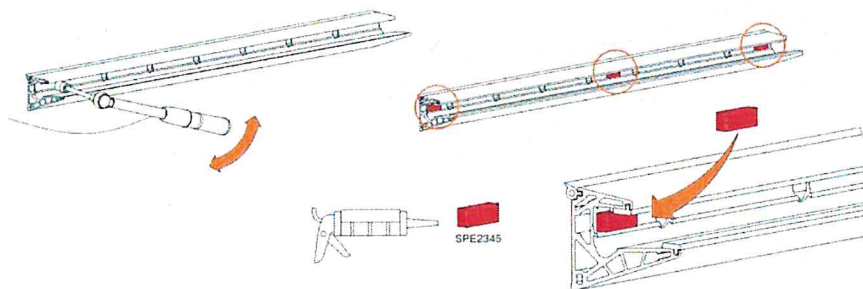
Step 1

Drilling the substructure at 200 mm intervals: the diameter of the holes depends upon the type of substructure and upon the adopted anchoring system. After making the first holes, the base rail can be used as a template to mark the position of the anchoring elements on the substructure. The holes affect only the substructure, since the base rail is supplied already drilled and with an inner groove suitable for housing the head of the anchoring elements.



Step 2

Installation of the base rail and tightening of the supporting screws: after fixing, it is recommended to insert the spacers, which are part of the clamping system, in the inner part of the rail, so to avoid accidental collisions of the glass plate in the subsequent installation phases.



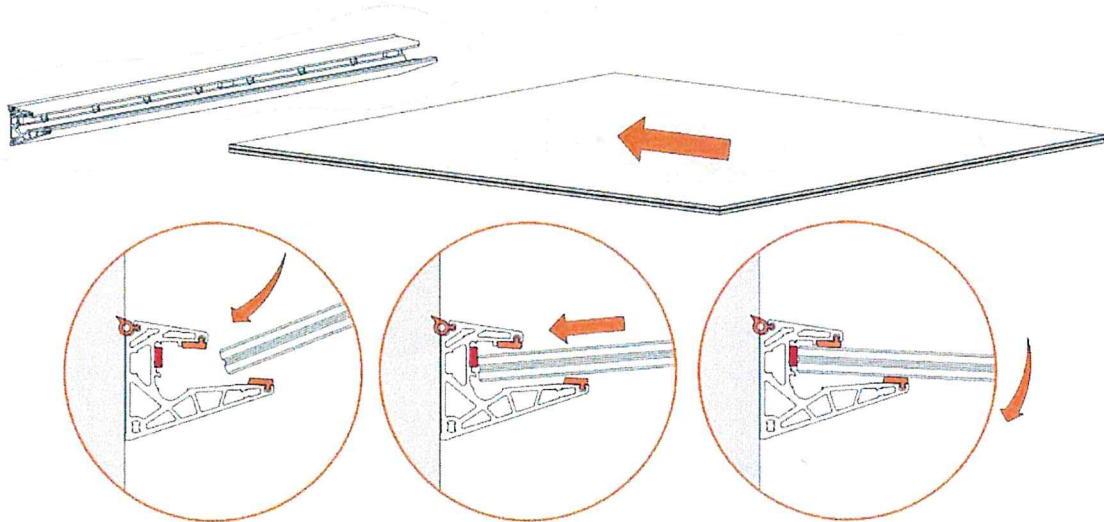
La Pensilina

Intended Use – Installation instructions

**Annex B2/1
of ETA N° 19/0181**

Step 3

Installation of the laminated glass plate: it must be inserted into the base rail via a movement from above downward, until the contact with the spacer. Then, the external free edge must be slowly lowered, until the contact with the two TPE seals. The correct installation of the plate guarantees that the system support the pane without the aid of external supports.



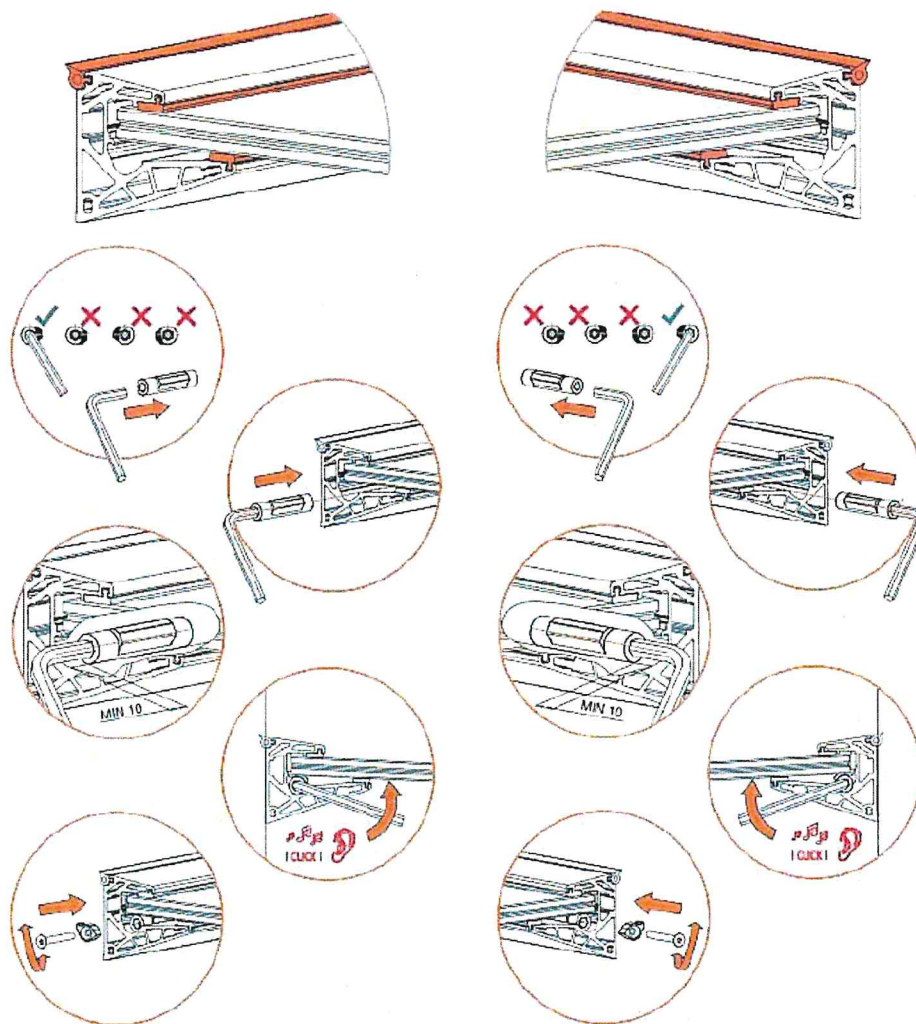
La Pensilina

Intended Use – Installation instructions

Annex B2/2
of ETA N° 19/0181

Step 4

Insertion of the safety cams, tightening by means of an Allen wrench up to snap (counterclockwise to LH and clockwise to RH): the rotation angle for tightening depends on the thickness of the installed plate. The operation is complete after the installation of the safety lock and the tightening of the respective screw on the safety cam.



La Pensilina

Intended Use – Installation instructions

**Annex B2/3
of ETA N° 19/0181**

Mechanical resistance and stability to snow and wind load – Descending Loads

The relation between overhang length of the cantilevered horizontal glazing and the permissible cumulative surface descending load is shown in Figure 1. The diagram is based on combination of results from calculations of system components assisted and verified by full-scale testing. The values of the characteristic surface descending loads for each horizontal glazing type at different overhang lengths are recorded in Table 5.

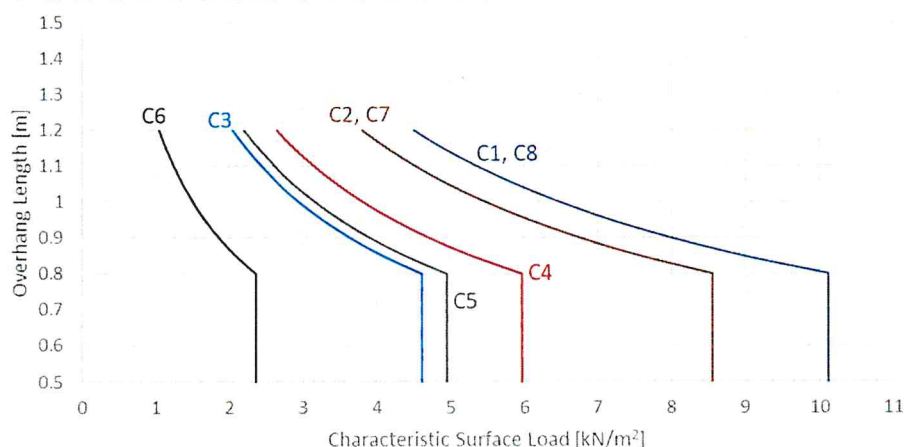


Figure 1. Correlation between overhang length and the characteristic descending load.

Overhang Length [m]	Characteristic Surface Descending Load							
	C1 [kN/m²]	C2 [kN/m²]	C3 [kN/m²]	C4 [kN/m²]	C5 [kN/m²]	C6 [kN/m²]	C7* [kN/m²]	C8** [kN/m²]
1.20	4.50	3.80	2.05	2.65	2.20	1.05	3.80	4.50
1.15	4.90	4.14	2.23	2.89	2.40	1.14	4.14	4.90
1.10	5.36	4.52	2.44	3.15	2.62	1.25	4.52	5.36
1.05	5.88	4.96	2.68	3.46	2.87	1.37	4.96	5.88
1.00	6.48	5.47	2.95	3.82	3.17	1.51	5.47	6.48
0.95	7.18	6.06	3.27	4.23	3.51	1.68	6.06	7.18
0.90	8.00	6.76	3.64	4.71	3.91	1.87	6.76	8.00
0.85	8.97	7.57	4.09	5.28	4.38	2.09	7.57	8.97
0.80	10.13	8.55	4.61	5.96	4.95	2.36	8.55	10.13
0.75	10.13	8.55	4.61	5.96	4.95	2.36	8.55	10.13
0.70	10.13	8.55	4.61	5.96	4.95	2.36	8.55	10.13
0.65	10.13	8.55	4.61	5.96	4.95	2.36	8.55	10.13
0.60	10.13	8.55	4.61	5.96	4.95	2.36	8.55	10.13
0.55	10.13	8.55	4.61	5.96	4.95	2.36	8.55	10.13
0.50	10.13	8.55	4.61	5.96	4.95	2.36	8.55	10.13

Table 5. Characteristic surface descending loads for different values of overhang length.

La Pensilina	Annex C1/1 of ETA N° 19/0181
Performances – Mechanical resistance and stability to snow and wind load	

Mechanical resistance and stability to snow and wind load – Ascending Loads

The relation between overhang length and the permissible cumulative surface ascending load is shown in Figure 2. The diagram is based on combination of results from calculations of system components assisted and verified by full-scale testing. The values of the characteristic surface descending loads for each horizontal glazing type at different overhang lengths are recorded in Table 6.

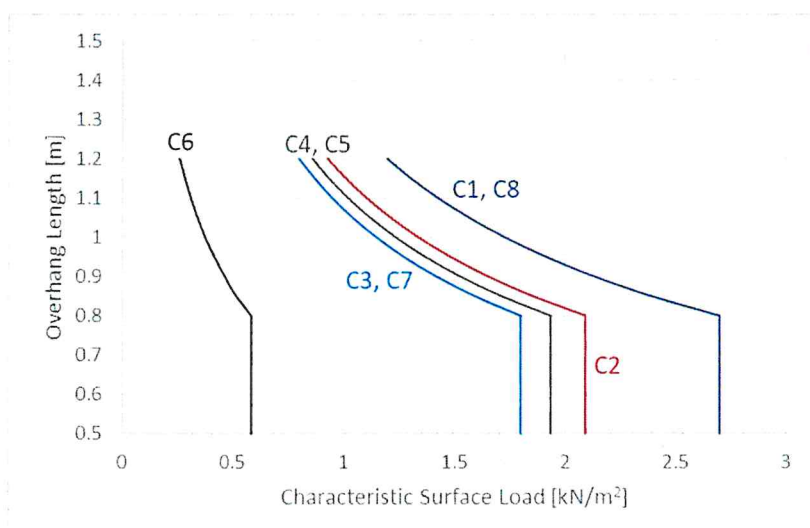


Figure 2. Correlation between overhang length and the characteristic ascending load.

Overhang Length [m]	Characteristic Surface Ascending Load							
	C1 [kN/m ²]	C2 [kN/m ²]	C3 [kN/m ²]	C4 [kN/m ²]	C5 [kN/m ²]	C6 [kN/m ²]	C7* [kN/m ²]	C8** [kN/m ²]
1.20	1.20	0.93	0.80	0.86	0.86	0.26	0.80	1.20
1.15	1.31	1.01	0.87	0.94	0.94	0.28	0.87	1.31
1.10	1.43	1.11	0.95	1.02	1.02	0.31	0.95	1.43
1.05	1.57	1.21	1.04	1.12	1.12	0.34	1.04	1.57
1.00	1.73	1.34	1.15	1.24	1.24	0.37	1.15	1.73
0.95	1.91	1.48	1.28	1.37	1.37	0.41	1.28	1.91
0.90	2.13	1.65	1.42	1.53	1.53	0.46	1.42	2.13
0.85	2.39	1.85	1.59	1.71	1.71	0.52	1.59	2.39
0.80	2.70	2.09	1.80	1.94	1.94	0.59	1.80	2.70
0.75	2.70	2.09	1.80	1.94	1.94	0.59	1.80	2.70
0.70	2.70	2.09	1.80	1.94	1.94	0.59	1.80	2.70
0.65	2.70	2.09	1.80	1.94	1.94	0.59	1.80	2.70
0.60	2.70	2.09	1.80	1.94	1.94	0.59	1.80	2.70
0.55	2.70	2.09	1.80	1.94	1.94	0.59	1.80	2.70
0.50	2.70	2.09	1.80	1.94	1.94	0.59	1.80	2.70

Table 6. Characteristic surface ascending loads for different values of overhang length.

La Pensilina	Annex C1/2 of ETA N° 19/0181
Performances – Mechanical resistance and stability to snow and wind load	

